26/4/2017 lec

$$E_\theta = \frac{\omega\mu I_0}{4\pi}\frac{e^{-j\beta r}}{r}\frac{\sin\theta}{\beta(1-\cos\theta)}\left(1-e^{-j\beta l(1-\cos\theta)}\right)$$

$$|E_\theta| = \frac{\omega\mu I_0}{4\pi r}\frac{\sin\theta}{\beta(1-\cos\theta)}\left|1-e^{-j\beta l(1-\cos\theta)}\right|$$

let $\psi = \beta l(1-\cos\theta)$

$$|1-e^{-j\psi}| = |1-(\cos\psi - j\sin\psi)|$$

$$= |(1-\cos\psi)+j\sin\psi|$$

$$= \sqrt{1-2\cos\psi+\cos^2\psi+\sin^2\psi}$$

$$= \sqrt{2-2\cos\psi}$$

$\sin^2\frac{\psi}{2} = \frac{1}{2}(1-\cos\psi)$

$\therefore (1-\cos\psi) = 2\sin^2$

$$= \sqrt{2(1-\cos\psi)}$$

$$= \sqrt{2\times 2\sin^2\frac{\psi}{2}}$$

$$= 2\sin\frac{\psi}{2} = \boxed{2\sin\frac{\beta l}{2}(1-\cos\theta)} \quad \#$$

$$|E_\theta| = \frac{\omega\mu I_0}{4\pi r}\sin\theta\frac{2\sin\frac{\beta l}{2}(1-\cos\theta)}{\beta(1-\cos\theta)}\times\frac{l}{l/2}$$

$$|E_\theta| = \frac{\omega\mu I_0 l}{4\pi r}\sin\theta\frac{\sin\frac{\beta l}{2}(1-\cos\theta)}{\frac{\beta l}{2}(1-\cos\theta)}$$

$$|E_\theta| = \frac{\omega \mu I_o L}{4\pi r} \sin\theta \; Sa\left(\frac{\beta L}{2}(1-\cos\theta)\right)$$

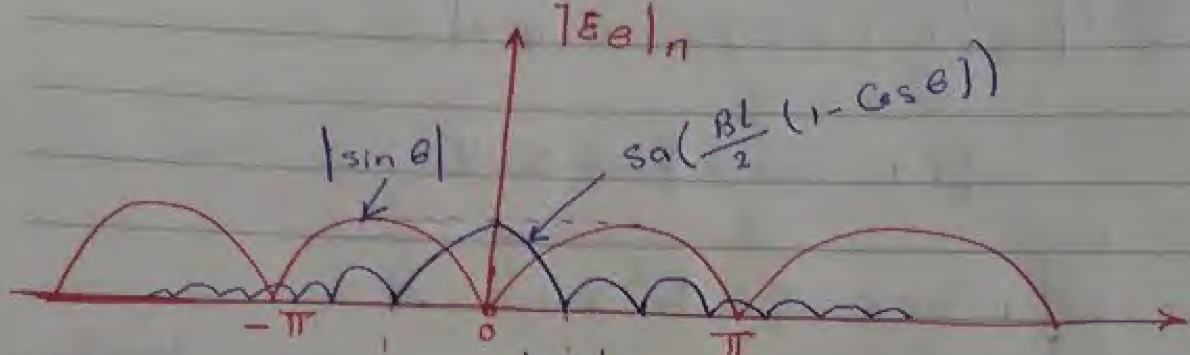
عامل ضرب دالتين

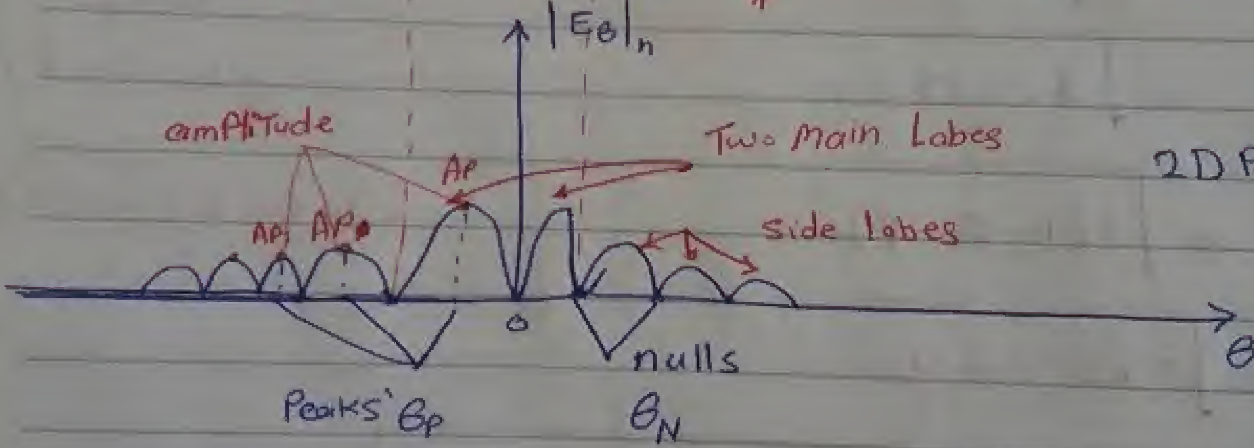
وجود الـ sin بسبب مشاكله كبيره في شكل الاشعاع الى طالع

هنا Traveling wave antenna

Magnitude فنشل الـ

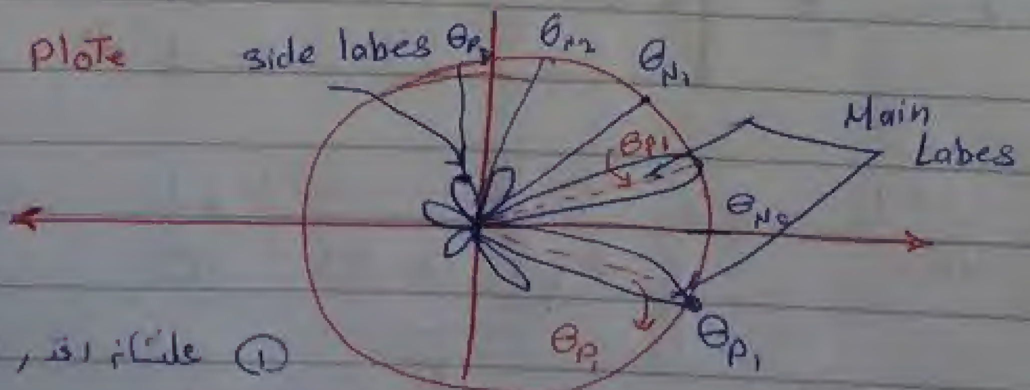
$$|E_\theta|_{normalize} = \sin\theta \cdot Sa\left(\frac{\beta L}{2}(1-\cos\theta)\right)$$





2D Plote

* Polar PloTe



① علشان اقدر ارسم الرسم ده

①

* To Plote This Pattern We Must determine

1. location of nulls θ_N
2. location of Peaks θ_P
3. amplitudes AP_N

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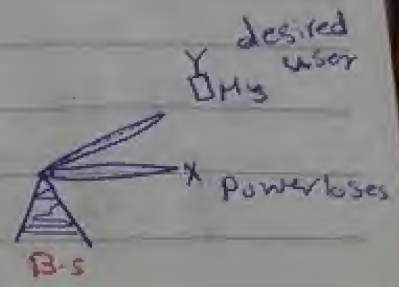
* Advantage of TWA s

1. Very High gain and directivity

---

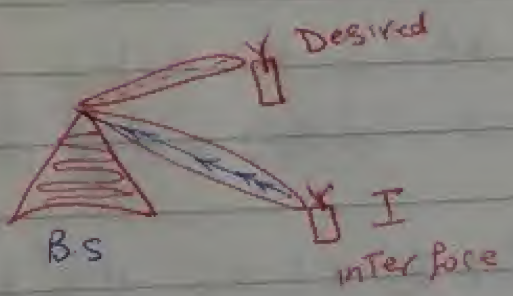
* disadvantage

1. require large area
2. it has Two Main labes



① in Case of Transmission
it Causes a source of Power loss

② in Case of reception it
Causes a source of
interference.



* سؤال ليه ال directive بتاعت TWA عالية

*
location

location of Nulls :→

$$|E_\theta| = \sin\theta \cdot Sa\left(\frac{\beta l}{2}(1-\cos\theta)\right)$$

nulls ↓ ↘ nulls

for: $\sin\theta_N = 0$ accure of $\boxed{\theta_N = n\pi}$ $\boxed{n = 0}, 1, 2, 3 \ldots$

$$\rightarrow Sa\left(\frac{\beta l}{2}(1-\cos\theta_N)\right) = 0$$

$$\frac{\sin \frac{\beta l}{2}(1-\cos\theta_N)}{\frac{\beta l}{2}(1-\cos\theta_N)} = 0$$

(numerator → = 0)

البسط لازم يساوي (0) كدا

$$\sin\left(\frac{\beta l}{2}(1-\cos\theta_N)\right) = 0$$

$$\frac{\beta l}{2}(1-\cos\theta_N) = n\pi$$

$$\beta l(1-\cos\theta_N) = 2n\pi$$

$$(1-\cos\theta_N) = \frac{2n\pi}{\beta l} = \frac{2n\pi}{2\pi}\cdot\frac{\lambda}{L} = \frac{n\lambda}{L}$$

$$\cos\theta_N = \left(1 - \frac{n\lambda}{L}\right)$$

$$\theta_N = \cos^{-1}\left(1 - \frac{n\lambda}{L}\right) \quad \boxed{n = 1}, 2, 3, 4, 5, \ldots$$

(n λ → ×2, L → ×2; Sa above the box)

لأن دالة الـ Sa عند الصفر = 1

let $K = 2n$ في حالة التعويض n = 1, 2, 3, 4

$K = 2, 4, 6, 8, 10 \ldots$ $\boxed{even}$

$$\theta_N = \cos^{-1}\left(1 - \frac{2n\lambda}{2L}\right)$$

$$\theta_N = \cos^{-1}\left(1 - \frac{K\lambda}{2l}\right) \quad K = \boxed{0}, 2, 4, 6, 8, \ldots$$

sin

عدد زوجي

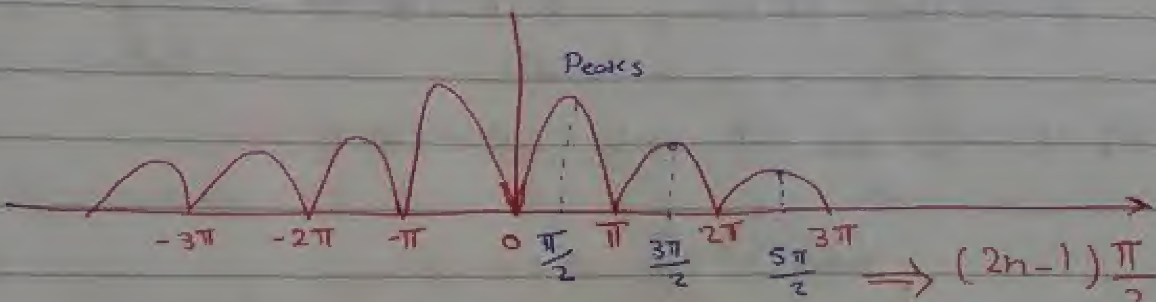
* لو $4\lambda = l$

$$\theta_N = \cos^{-1}\left(1 - \frac{K \cancel{\lambda}}{2 \times 4 \cancel{\lambda}}\right)$$

احسب الـ nulls [8]

احسب Peaks 8 احسب العدد اللي ظهر عندك # على حسب

اداكي 8 او 16



$\Rightarrow (2n-1)\frac{\pi}{2}$

$$Sa\left(\frac{\beta l}{2}(1 - \cos\theta_p)\right) = Max$$

$$\frac{\beta l}{2}(1 - \cos\theta_p) = (2n-1)\frac{\pi}{2} \qquad n = 1, 2, 3, 4, \ldots$$

$$(1 - \cos\theta_p) = (2n-1)\pi \frac{\lambda}{2\pi \cdot l}$$

$$(1 - \cos\theta_p) = \frac{(2n-1)\lambda}{2l}$$

$$\cos\theta_p = 1 - \frac{(2n-1)\lambda}{2l}$$

$$\theta_p = \cos^{-1}\left(1 - \frac{(2n-1)\lambda}{2l}\right) \qquad n = 1, 2, 3, \ldots$$

let $K = (2n-1) = 1, 3, 7, \ldots$ odd

$$\theta_p = \cos^{-1}\left(1 - \frac{k\lambda}{2l}\right) \qquad k = 1, 3, 5, 7, \ldots$$

فردي

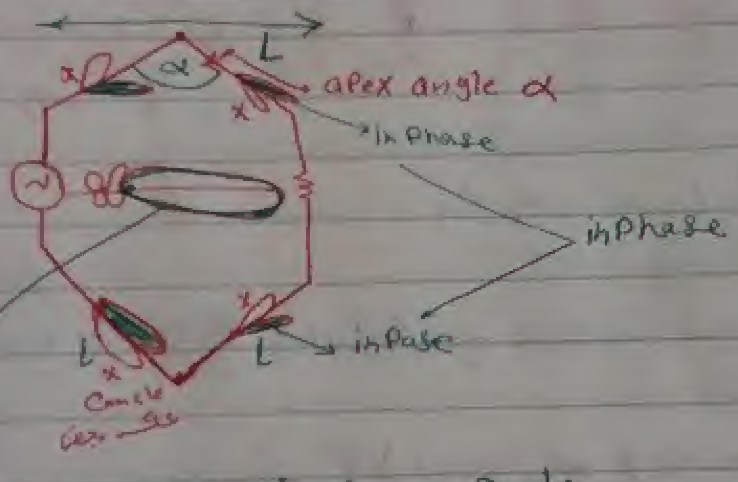
$$AP_n = \frac{\sin \theta_p}{1 - \cos \theta_p}$$

Amplitude

* How To solve The Two main labes Problems of TWA ?? — 2 Main labes كيف حل مشكلات

الحل استخدام شكل معين

- By Using The (Rhombic) anTenna



* Single Main lobes of $\theta = 0$ angle

disadvanTage — لكن

losT $\frac{1}{2}$ Power

$$\alpha = 2\sin^{-1}\left(1 - \frac{\lambda}{2l}\right)$$

To Design Rhombic anTenna

علشان اصمم معاه ٤ TWA [illegible] نحسب الـ α

[illegible] Cancle